PLANNING AND REVIEW OF ACCELERATOR FACILITIES AND THEIR OPERATIONS

INTRODUCTION

This FESHM chapter describes the formal review procedures established by the Laboratory to assure that accelerator facilities and their operations comply with Fermilab ES&H standards and with DOE O 420.2B, *Safety of Accelerator Facilities*. This review system shall be applied to new projects or when significant modifications, including decommissioning, occur. The level of detail required in the Safety Assessment Documents (PSAD/SAD) and the amount of resources expended in the accelerator readiness review (ARR) and its accompanying documentation should be commensurate with the programmatic importance and potential ES&H impact of the facility and its activities. The Fermilab Environment, Safety and Health Manual (FESHM), inclusive of the Fermilab Radiological Control Manual (FRCM), specifies a set of physical and administrative conditions that define the bounding conditions for safe operation of accelerator facilities or portions thereof.

In addition to the Safety Assessment Documents (SADs), Fermilab conducts other types of reviews of new projects to assure that environment, safety, and health requirements are met. For example FESHM 8060 describes in detail the Laboratory's program for reviewing its activities under the National Environmental Policy Act (NEPA). Likewise, planning for future decontamination and decommissioning (D&D) activities are to be developed as specified in FESHM 8070. Specific general work planning documentation requirements and practices not within the scope of FESHM 2010 are found in other FESHM chapters in the 2000 series. Documentation requirements related to work involving ionizing radiation are covered in the FRCM.

The Fermilab Director, as advised by the ES&H Director, determines the PSAD/SAD applicability, notifies the responsible division/section/center and gives guidance on the level of details required. Divisions, sections, and centers are responsible for maintaining their SADs and associated Accelerator Safety Envelopes (ASEs) up-to-date by revising them when necessary. Beginning October 1, 2009, SAD's shall be reviewed not less than every 5 years. At a minimum, all SADs shall have Document number, Revision, Issue and Date in the heading in accordance with Directors Policy Manual

No. 13.000 (http://www.fnal.gov/directorate/Directors_Policy/document_control.shtml). Revised SADs and ASEs shall be reviewed and approved in accordance with the procedures of this chapter (FESHM 2010). FESHM 2010 is based on the content of DOE G 420.2-1, *Accelerator Facility Safety Implementation Guide for DOE O 420.2B, Safety of Accelerator Facilities* (7/2/05).

SADs commonly include a radiation shielding assessment or incorporate the results of a separate Shielding Assessment document. Requirements and guidance concerning the shielding of ionization radiation and the preparation and approval of shielding assessments are described in FRCM Chapter 8. FRCM Chapter 8, in the context of the entire FRCM, constitutes the radiation shielding policy required by DOE O 420.2B and conforms to the guidance on such policies provided by DOE G 420.2-1. Radiation shielding assessments are described in more detail on FRCM Chapter 8. Such shielding assessments are reviewed by the Shielding Assessment Review Subcommittee of the Fermilab ES&H Committee (FESHCom). The charter of this subcommittee is at https://esh-docdb.fnal.gov:440/cgi-bin/ShowDocument?docid=1089). For non-ionizing radiation, the FESHM, specifically FESHM 1070, FESHM 5062.1, and FESHM 5062.2 constitute the required shielding policy.

SELECTED DEFINITIONS

- Accelerator: A device employing electrostatic or electromagnetic fields to impart kinetic energy to molecular, atomic or sub-atomic particles and, for the purposes of this chapter (FESHM 2010), capable of creating a radiological area as defined by Regulation 10 CFR Part 835, "Occupational Radiation Protection", and the FRCM. The following devices are not considered to be accelerators under DOE O 420.2B and hence this FESHM Chapter (2010), but are otherwise subject to FRCM Article 362:

    - Unmodified commercially available units that are acceptable for industrial applications, including (but not limited to) electron microscopes, ion implant devices, and x-ray generators.

    - Nonmedical x-ray devices with the capability of accelerating particles to energies not greater than 10 MeV, which are operated in accordance with American National Standards Institute N43.3-1993, *General Radiation Safety Standard for Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies Up to 10 MeV*, or in accordance with another

consensus standard as directed by the Department of Energy Fermi Site Office (DOE-FSO).

- Low-voltage neutron generators incapable of creating high radiation areas (as defined in the FRCM and in 10 CFR Part 835), which are operated in accordance with National Council on Radiation Protection and Measurements NCRP Report 72, *Radiation Protection and Measurements for Low-Voltage Neutron Generators*, or in accordance with another applicable consensus standards as directed by DOE-FSO.

- Accelerator Component: Components used within an accelerator such as but not limited to radio-frequency (RF) cavities, electrostatic separators, kickers, pingers, and choppers when tested by themselves, do not by themselves meet the definition of an accelerator, although these devices may produce x-rays. These devices are managed in accordance with 10 CFR Part 835 as implemented in the FRCM, and with provisions of the FESHM. They do not require a separate Safety Assessment Document (SAD) or Accelerator Safety Envelope (ASE) when tested and operated as a stand-alone component. Documented hazard assessments of stand-alone facilities used in testing and research and development of such components are required to be conducted as part of Fermilab's implementation of Integrated Safety Management Systems (ISMS) and Radiation Protection Program (RPP) guidance in accordance with provisions of FESHM and FRCM requirements consistent with DOE G 420.2-1.

- Accelerator Facility: The accelerator and associated plant and equipment utilizing, or supporting the production of, accelerated particle beams to which access is controlled to protect the safety and health of persons. It includes injectors, targets, cryogenic systems, beam deflection devices, instrumentation, beam absorbers, radiological shielding, detectors, experimental enclosures and experimental apparatus utilizing the accelerator, regardless of where that apparatus may have been designed, fabricated, or constructed.

- Accelerator Readiness Review (ARR): A structured method for verifying that hardware, personnel, and procedures associated with commissioning and/or routine operation are ready to permit the activity to be undertaken safely. Upon satisfactory completion of the review and close-out of significant issues, *approval to operate* is signified by signatures on the PSAD/SAD/ARR Documentation form

attached to this chapter (FESHM 2010). See also the definition of Operations Envelope provided below.

- Accelerator Safety Envelope (ASE): A set of physical and administrative conditions that defines the accelerator/storage ring beam bounding conditions for safe operations.

- Commissioning: The process of testing an accelerator facility, or portion thereof, to establish the performance characteristics. It starts with the first introduction of a particle beam into the system.

- Exclusion Area: An area that is locked and interlocked by the Radiation Safety Interlock System to prevent personnel access while the accelerator is in operational status.

- Experimenters: All persons directly involved in experimental efforts at the accelerator utilizing the accelerator or its beams, including visiting scientists, students and others who may not be employees of Fermilab, the DOE Management and Operating (M&O) contractor.

- Hazard: A source of danger (i.e., material, energy source, or operation) with the potential to cause illness, injury, or death to personnel or damage to a facility or to the environment.

- Hazard Analysis: A tool used to plan work not specifically otherwise addressed by this chapter (FESHM 2010). See FESHM 2060.

- Operations Envelope: A set of physical and administrative conditions that may be defined within the ASE for individual subsets of operations or modules of the accelerator/storage ring beam. The operations envelope defines nominal operating parameters beyond which the operating procedures would require adjustments to be made. An operations envelope serves to prevent the ASE from being exceeded. Variations of operating parameters within an appropriate operations envelope are considered within the scope of normal operations. Variation outside the operations envelope but within the ASE merits appropriate attention; it does not require termination of activities or notification of DOE.

- Preliminary Safety Assessment Document (PSAD): A preliminary formal review document to analyze Laboratory projects, operations and experiments for possible hazards and possible ways to mitigate them. For a major project, Fermilab may choose to prepare a PSAD to support deliberations leading to *approval to initiate construction*.

- Project Leader: The individual assigned primary responsibility for the overall conduct of a given activity subject to the provisions of this chapter (FESHM 2010). This is the person to whom Fermilab management has assigned the responsibility for schedule and performance specifications and financial stewardship. This individual may also be designated the Project Manager in conformance with project management requirements specified by DOE Orders.

- Radiation Protection Program (RPP): The documented program, approved by DOE, including but not limited to the plans, schedules, and other measures developed and implemented to achieve and ensure continuing compliance with 10 CFR Part 835 and apply the "as low as reasonably achievable" (ALARA) process to occupational and environmental radiation dose (see FRCM).

- Risk: A quantitative or qualitative expression of possible harm, which considers both the probability that a hazard will cause harm and the amount of harm. The risk assignment methodology of FESHM 1040.3 should be used for this purpose unless superseded by methodologies otherwise specified.

- Routine Operation: Routine operation commences at the point where authorization has been granted either (1) because the commissioning effort is sufficiently complete to provide confidence that the hazards are both understood and acceptable and the operation has appropriate safety bounds, or (2) to permit the re-introduction of a particle beam after being directed to cease operation by DOE because of an environment, safety, or health concern that has been assessed and resolved to the satisfaction of both the Director and DOE-FSO.

- Safety Analysis: A documented process to systematically identify the hazards of a given operation; describe and analyze the adequacy of measures taken to eliminate, control, or mitigate the hazards of normal operation; and identify and analyze potential accidents and their associated hazards.

- Safety Assessment Document (SAD): A formal review document describing the analysis of Fermilab projects, operations and experiments for hazards and their final method of mitigation.

- Safety Class Structures, Systems, or Components (SCSSCs) – (See FESHM 3010.) The structures, systems, or components, including portions of process systems, whose preventive or mitigative function is necessary to limit radioactive or hazardous material exposures to the public as determined from safety analyses. Potential latent effects are excluded. The SCSSCs for Fermilab are

  - ✓ Radiation Safety Interlock System
  - ✓ In-Place Oxygen Deficiency Monitors/Alarm System
  - ✓ Flammable Gas Detection System
  - ✓ Pressure Relief Systems for Cryogenic Vessels
  - ✓ Passive Radiation Shielding Configurations for Accelerators and Beamlines

- Un-reviewed Safety Issue (USI): An issue that is discovered with existing accelerator or experiment that will either (1) significantly increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety from that evaluated previously by safety analysis; or, (2) introduce an accident or malfunction of a different type than any evaluated previously by safety analysis that could result in significant consequences. USIs are thus usually related to hazards and their consequences that may have been overlooked or underestimated in the safety assessment process.

PSAD/SAD PROCESS DESCRIPTION

The Accelerator PSAD/SAD and the associated ARR process is initiated with either a recommendation by the ES&H Director to the Fermilab Director concerning the applicability of PSAD/SAD for a proposed project, operation or experiment or a similar determination by the division/section/center head(s) responsible for the activity. Often, multiple divisions/sections/centers may share these responsibilities. For projects of limited scope, the PSAD step may not be required. The ES&H Director shall document these determinations and whether or not a PSAD is required at the earliest possible stage of conceptual design.

Following this determination of applicability, if required, the responsible division/section/center will prepare a PSAD, the approval of which allows initiation of more detailed design and/or construction.

The role of a PSAD is largely to identify those environment, safety, and health issues that are not adequately addressed by common industrial practices performed within boundaries set by federal regulations and by standard-setting bodies (e.g., ANSI, AMSE, NFPA).

The role of the SAD is to document the measures taken to successfully mitigate these issues and how these mitigative measures are to be folded into routine operation of the accelerator or accelerator module. Thus, if required, the PSAD is prepared at the earliest stage of project development; when the necessary broad conceptual understanding of potential project ES&H issues of required information is available. Then, when detailed hazard analyses and mitigation methodologies are better understood (e.g., a more advanced stage of design), the SAD is prepared. The SAD shall incorporate a risk assessment conducted using a systematic methodology. The risk assignment methodology stated in FESHM 1040.3 is recommended. Alternates may be used but should clearly be stated or referenced in the SAD. Completed PSADs or SADs shall be submitted to the ES&H Section for review.

For new projects or for those that have been significantly modified, a documented ARR conducted by the ES&H Section at a time prior to commissioning activities but at a sufficiently advanced stage of the project to assure validity must be completed. The schedule for the ARR should be done with concurrence between the ES&H Director, the project management leader as assigned by Fermilab management, and the hosting division/section/center head. The ARR may result in a list of items that need to be completed (punch list) before the approval to operate is granted. Upon successful completion of the review by the ES&H Section and close-out of all significant issues, the ES&H Director then recommends approval of the final SAD/ARR to the Fermilab Director.

Experience has indicated that this process is greatly enhanced by timely, effective collaboration and communication between the responsible division/section/center(s) and the ES&H Section. Involvement of representatives of the DOE-FSO at an early stage of project planning has also been found to be highly beneficial.

Each one of the above steps is described in detail below. These steps should be followed in sequential order.

1. Determination of Applicability

The ES&H Director regularly reviews projects, operations, and experiments for applicability of the provisions of this chapter (FESHM 2010) and makes corresponding recommendations to the Fermilab Director concerning SAD/PSAD applicability. This is done by the ES&H Director as a member of the Fermilab Senior Management Team. All DOE-FSO Project Directives are also reviewed for applicability of the requirements of this chapter (FESHM 2010). Division/section/center head(s) shall inform the ES&H Director of new projects, operations, and experiments that are candidates for SADs or SAD modifications at the earliest reasonable stage. Fermilab-authorized operations that originate outside the Laboratory are also reviewed for applicability of the requirements of this chapter (FESHM 2010).

Following the determination of applicability, the ES&H Director notifies the responsible division/section/center(s) of the PSAD/SAD applicability. This formal notification is not needed if the responsible organization(s) have already determined that a PSAD/SAD is to be revised or prepared. This determination and subsequent PSAD/SAD initiation must occur during the earliest phases of the activity to facilitate early hazard identification and mitigation. The documentation for the determination of applicability shall be inventoried and filed with the ES&H Section regardless of the conclusion.

A new PSAD/SAD is not required for upgrades to an existing facility or operation that are within the scope of its existing SAD. Documentation demonstrating that the upgrade is within the scope of the existing SAD shall be written by the responsible division/section/center(s) and be filed with the ES&H Section. Addenda to existing SADs provide a venue for maintaining up-to-date safety assessment documentation. SAD addenda proceed through the same approval process as does a new SAD.

2. PSAD Hazard Analysis

The PSAD should follow the guidelines outlined in the technical appendix to FESHM 2010, FESHM 2010TA. The hazards associated with construction,

installation, operation, and decommissioning should be identified. In general, the hazard analysis in the PSAD should start with the Written Hazard Analysis Guideline found in FESHM 2060. For large or complex projects, the Issues List appended to this chapter is recommended for providing a technical basis for such a hazard analysis. This Issues List was originally generated as part of the Necessary and Sufficient Process carried out at Fermilab in 1995 and is the result of a comprehensive analysis of the hazards present on the Fermilab site. It is also found on the ES&H Docdb at: https://esh-docdb.fnal.gov:440/cgi-bin/ShowDocument?docid=776. This Issues List is a starting point; the required comprehensive analysis could identify additional issues.

Once the hazards associated with the project through construction, installation, operations, and decommissioning are identified, the initiating event, consequences of an incident associated with each hazard, its mitigation should be identified.

For the most part, the common industrial or environmental hazards associated with a project which do not pose any additional hazard by virtue of their association with the project's construction, installation, commissioning, operation, or decommissioning are addressed by implementing the provisions of other FESHM chapters. For such hazards, it can simply be stated that the Work Smart Set of Standards (WSS, see FESHM 1070) or commonly accepted standards (e.g., ASME, ANSI, NFPA) will be followed just as they would for other operations on site.

Preliminary shielding assessments for ionizing radiation may be performed separately from the PSAD. Summaries of the analysis shall be incorporated into the PSAD documentation. Recognizing that the PSAD often must be written before the construction drawings are detailed enough to perform the preliminary shielding assessment such preliminary radiation shielding assessments may of necessity be "iterative" in nature, conducted concurrently with facility design. Formal Radiation shielding assessments shall be conducted in accordance with provisions of FRCM Chapter 8 prior to the bidding of construction bid packages when designs are final, or very near final.

3. SAD Hazard Analysis

The SAD should follow the same guidelines as those given for the PSAD while documenting the mitigation of unique hazards found throughout the commissioning and operational life of the project as well preliminary plans for the eventual decommissioning of the facility module. The conclusions of the SAD will support the parameters of the associated Accelerator Safety Envelope (ASE). Commonly, the ASE constitutes a chapter or a portion of a chapter of the SAD.

The division/section/center (s) commonly choose to review new projects or facilities by means of one or more safety review panels. Such safety panels may consist of laboratory staff or experts from outside the Laboratory. The responsible division/section/center may request assistance from the Laboratory Safety Committee and its subcommittees to review projects, answer specific safety questions, recommend solutions to ES&H problems, assist in setting ES&H policy, or evaluate requests for exemptions from existing policies. The results of these reviews should be incorporated into SAD documentation.

Shielding assessments for ionizing radiation may be performed separately from the SAD. However summaries of the analysis shall be incorporated into the SAD documentation. Radiation shielding assessments shall be conducted in accordance with provisions of FRCM Chapter 8 (see above).

4. Review of PSAD/SAD

The Safety Assessment Document Review Subcommittee of the Fermilab ES&H Committee (FESHCom) is responsible for reviewing the results of each safety assessment document chapter for completeness and compliance with this FESHM Chapter as specified in more detail in its charter (https://esh-docdb.fnal.gov:440/cgi-bin/ShowDocument?docid=1090.) As part of its duties, this subcommittee is charged with submitting reports to the ES&H Director recommending acceptance or rejection for cause of SADS based on the consensus of the subcommittee. . For SADs/Accelerator Readiness Reviews concerned with strategic or major system projects (as defined by DOE) or line item projects, one or more representatives of DOE-FSO may be included as observers on the assigned review team preparatory to the official transmittal for concurrence by DOE-FSO. The list of reviewers of each SAD shall be documented along with any review comments they contribute.

5. PSAD/SAD and ARR Approval

a. The ES&H Director coordinates the reviews of PSADs and SADs and their approval by the Fermilab Director unless the Fermilab Director specifies an alternative review procedure.

Following completion of the Fermilab review, all SADs that result in a new or revised Accelerator Safety Envelope (ASE) are transmitted to DOE-FSO for written concurrence with the SAD and written approval of the ASE. Normally, PSADs are not formally transmitted to the DOE-FSO for concurrence but might be sent to DOE-FSO for informational purposes as part of project oversight activities.

The final sign-off sheet to be used for PSAD/SAD and ARR approval appears as the last page of the technical appendix to this chapter, FESHM 2010TA. PSAD/SAD and ARR approval and approval to commence commissioning/operation requires the following signatures which shall be routed in the following order:

1. Project Leader
2. Fermilab Division/Section/Center Head(s)
3. Fermilab ES&H Director
5. Fermilab Director

b. The SAD along with any new or revised ASE, and documentation of any applicable ARR process shall be sent to the DOE-FSO Manager for concurrence and approval of the ASE before commissioning or operations ensue. This formal transmittal should occur after completion of the internal review process documented by the above signatures. If no comments or replies are received within 30 calendar days, it will be assumed that the SAD or ARR and the ASE are sufficient unless the DOE-FSO Manager has established a different review schedule. This comment period will normally be 15 calendar days provided that a SAD that has undergone preliminary review by the ES&H Section, complete with proposed ASE, is informally provided to the DOE-FSO Manager at least 30 calendar days prior to the formal submittal of the signed, completed SAD and ASE.

The DOE-FSO Manager will be informed of the readiness review before its occurrence and be given the opportunity to observe the review. Experience has shown that early involvement of representatives of the DOE-FSO can enhance the effectiveness of this review process.

6. Documentation

The completed, original PSAD/SAD and specific supporting documentation related to the review shall be inventoried and filed with the ES&H Section in a manner consistent with applicable records retention requirements.

7. Un-reviewed Safety Issue (USI)

Subsequent to the issue of a SAD, the discovery of a USI as defined by this chapter (FESHM 2010) constitutes a reportable occurrence to be addressed and reported in accordance with DOE O 420.2B and FESHM 3010. Activities stopped as a result of an identified USI shall not resume or commence operations without written approval of the DOE-FSO Manager.

Procedure for Addressing Un-reviewed Safety Issues (USIs)

a. Upon discovery, the event that might constitute a USI should be reported by the responsible division/section/center(s) to the ES&H Director and the Fermilab Director.

b. The ES&H Director shall determine whether the event is a USI as defined by DOE O 420.2B and document that decision. The process of determining USI status may be discussed with DOE-FSO as part of the overall determination process.

c. Identified USIs shall be reported to DOE-FSO along with relevant support documentation. Operation of the identified accelerator module or facility will be stopped until such time as the USI is resolved and approval to return to operations is provided.

d. Corrective actions to address the USI shall be documented in the DOE Occurrence Reporting System (ORPs).

e. Where necessary, SADs and ASEs shall be revised and reviewed on the basis of the new information obtained from the USI and submitted to DOE-FSO in accordance with the provisions of this chapter (FESHM 2010).

f. The USI shall be resolved to the satisfaction of DOE-FSO prior to a Fermilab request for DOE-FSO approval to commence or resume routine operations.

g. DOE-FSO may require a technical briefing on the status of the USI as part of the process to request resumption of operations. Approval by DOE-FSO will be contingent on resolution of the USI and completion of any technical review of the circumstances leading to the USI.

h. DOE-FSO approval will be required before resumption of operations

ISSUES LIST OF HAZARDS IDENTIFIED ON THE FERMILAB SITE

This list was developed as a part of the Necessary and Sufficient Standards process carried out in 1995 and is intended to be a starting point for analysis. The code numbers were those associated with the 1995 exercise but can still be used as an aid in the hazard analyses specified by this chapter.

001. Bio - animals
002. Bio - bacteria (water)
003. Bio - bloodborne pathogens
004. Bio - insects
005. Bio - plants
006. Chem - acids, solvents, toxic agents and haz. liquids
007. Chem - carbon monoxide
008. Chem - carcinogens
009. Chem - chemical exposures exceeding PEL.
010. Chem - chemical reactions
011. Chem - cutting and burning
012. Chem - heavy metals such as lead
013. Chem - nuisance dusts
014. Chem - pesticides
015. Chem - toxicity in smoke or fumes
016. Chem - use of toxic materials
017. Chem - welding fumes
018. Construction - compressed gasses
019. Construction - demolition
020. Construction - dewatering hazard
021. Construction - earth cave-in and collapse
022. Construction - earth moving equipment
024. Construction - earth clearing
025. Construction - fall hazards
027. Construction - hand tools
028. Construction - heavy equipment
029. Construction - high winds
030. Construction - ladder
032. Construction - materials handling
033. Construction - possibility of hitting utilities
034. Construction - scaffolding
035. Construction - transportation
036. Electricity - battery
037. Electricity - exposed conductors / >50 volts
038. Electricity - high voltage
039. Electricity - high power
040. Electricity - lightning
041. Electricity - high current conductors / <50 volts
042. Electricity - stored energy / capacitors

043. Electricity - stored energy / inductors
044. Env - air emissions / nonrad
045. Env - air emissions / rad
046. Env - cultural resources
047. Env - asbestos
048. Env - drinking water quality
049. Env - endangered species
050. Env - groundwater protection
051. Env - hazardous waste
052. Env - offsite radiation protection / penetrating
053. Env - ozone depleting substances
054. Env - PCBs
055. Env - pesticide application and use
056. Env - regulated chemical waste / non-hazardous
058. Env - sanitary and sewer discharges
059. Env - solid waste management units and inactive waste sites
060. Env - surface water
061. Env - transformer oil / non-PCB
062. Fire - boiler, heating systems, and (commercial) appliances
063. Fire - cigarette smoking
064. Fire - electrical
065. Fire - flammable liquids and gases
066. Fire - mobile structures
067. Fire - special hazardous materials
067B. Fire - hydrogen targets
068. Fire - special occupancies / accelerator and beam line enclosures
069. Fire - spontaneous combustion
070. Fire - stationary combustion engines
071. Fire - storage of combustibles
072. Fire - transportation / rail, vehicle, and fueling
073. Fire - welding near combustibles
074. Fire - spark producing tools near combustibles
075A. HazMat transport - bad road conditions / offsite
075B. HazMat transport - bad road conditions / onsite
076A. HazMat transport - emergency response and spill clean up / offsite
076B. HazMat transport - emergency response and spill cleanup / onsite
077A. HazMat transport - fire and explosion / offsite
077B. HazMat transport - fire/explosion / onsite
078A. HazMat transport - loading and unloading / offsite
078B. HazMat transport - loading and unloading / onsite
079A. HazMat transport - packaging hazardous materials / offsite
079B. HazMat transport - packaging hazardous materials / onsite
079C. HazMat transport - transportation of radioactive materials
080A. HazMat transport - prolonged periods of driving / offsite
080B. HazMat transport - prolonged periods of driving / onsite

081A. HazMat transport - spills and chemical releases /offsite
081B. HazMat transport - spills and chemical Releases / onsite
081C. Hazardous material transport - spills and chemical releases
082. Magnetic fields - bioelectric implants
083. Magnetic fields - fringe fields
084. Magnetic fields - high magnetic fields
085. Magnetic fields - quench effects
086. Material handling - chemical spills
087. Material handling - cranes and hoists
088. Material handling - elevators used for hazardous material
089. Material handling - falling objects
090. Material handling - forklift operation
091. Material handling - hazardous tools equipment and machinery
092. Material handling - lifting objects
093. Material handling - moving objects
094. Material handling - storage and handling of toxic materials.
095A. Material handling - transportation / offsite
095B. Material handling - transportation / onsite
096. NIR - intense light sources
097. NIR - lasers
098. NIR - radiofrequency radiation
099. NIR - ultraviolet light
101. ODH - cryogenic gas or liquid leaks
102. ODH - cryogenic spills
103. ODH - gaseous argon or other detector gas
104. ODH - leak of supplied gas
105B. ODH - mechanical refrigeration systems
106. Other mechanical hazards - general environmental control
107. Other mechanical hazards - machine guarding
108. Other mechanical hazards - machinery and rotating parts
109A. Other mechanical hazards - medical and first aid, blood borne pathogens, lead, noise, asbestos, and respiratory protection
109B. Surveillance - tuberculosis
110. Other mechanical hazards - powered platforms
111A. Other mechanical hazards - pressurized tanks and containers
111B. Other mechanical hazards - pressurized lines and piping systems
112. Other mechanical hazards - material grinding, cutting, and drilling
113. Other mechanical hazards (also fire) - means of egress
114. Other mechanical hazards - moving vehicles, carts, and forklifts
115. Other mechanical hazards - special hand tools and power driven nail guns, etc.
116. Other mechanical hazards - work with roads and grounds equipment
117. Other personal hazards - confined space
119. Other personal hazards - hazards requiring PPE
120. Other personal hazards - high noise levels

121. Other personnel hazards - housekeeping
122. Other personnel hazards - ice/walking surfaces
123. Other personal hazards - lifting and carrying heavy objects
124. Other mechanical hazards - pinch points
125. Other personal hazards - repetitive motion
126. Other personal hazards - sharp edges
127. Other personnel hazards - slips, trips & falls
128. Other personnel hazards - traffic hazards
129. Other personnel hazards - vacuum tanks
130. Other personal hazards - vibration
131. Other personnel hazards - work on wet surface
132. Other personnel hazards - working at heights
133. Radiation - radioactive contamination
134 Radiation - special nuclear materials (SNM) and nuclear materials
135. Radiation - mixed waste
136. Radiation - prompt radiation
137. Radiation - radioactive sources
138. Radiation - radioactivated soil
139. Radiation - radioactive liquids and gases
140. Radiation - radioactive waste
141A. Radiation - residual contamination
141B. Radiation - residual activity
143. Radiation - storage and handling of radioactive materials
144. Thermal - battery bank and UPS equipment
145. Thermal - cold work environments
146. Thermal - cryogens
147. Thermal - high temperature equipment
148. Thermal - hot work environments
149. Thermal - ultraviolet radiation / sun exposure
151. Thermal - wet work environments
152. Emergency preparedness - severe weather
153. Emergency preparedness - safeguards and security
154. Emergency preparedness - generic
155. Env - underground storage tanks
156. Other mechanical hazards - aviation
159. Emergency preparedness - hazardous materials
160. Emergency preparedness - toxicity in smoke or fumes
161. Env - general environmental protection planning
163. Occupational safety administrative requirements
164. Occurrence Investigation and Reporting
165. Radiation - radiological emergency response (see 154.)
166. Radiation - radiological training
167. Radiation - monitoring and measurement of radiation
168. Radiation - record keeping in occupational radiation protection
169. Radiation - exposure control

170. Radiation - QA in occupational radiation protection
171. Safety analysis and documentation
172. Fire - emergency responder safety

TECHNICAL APPENDIX TO FESHM 2010
PSAD/SAD GUIDELINES

The PSAD/SAD documents may contain references to other PSADs/SADs, procedures and documents as appropriate rather than repeating large portions of an existing document. Summaries of reference documents should be included where appropriate.

Where commissioning is to be accomplished in discrete modules, the SAD and/or the ARR may be conducted incrementally also. Each module shall require separate authorization.

The PSAD/SAD should be written in accord with the following outline, as applicable:

I. Introduction/Project Description

Provides a brief description of the project:

- Location
- Purpose of Project
- Organizational Responsibilities
- Identification of the Appropriate Safety Design Criteria and/or Standards

II. Inventory of Hazards and Mitigation

The PSAD/SAD may present the hazards and discuss their mitigation in a chronological order, i.e. hazards associated with the construction phase, installation, operations, and finally D&D. FESHM 2060, Table 1 and the Issues List appended to FESHM 2010.

Hazard mitigation often includes:

- Shielding analysis
- Engineering design
- Operational constraints
- Training requirements
- Procedural requirements

- Applicable administrative controls
- Accelerator Safety Envelope

  The safety envelope may contain or reference other sections of the SAD that address the following issues as requirements for operation:
  * Power limits (particles, energy, duty factor, or equivalents)
  * Personnel specifications (e.g. operator training)
  * Safety systems which must be operational (e.g. radiation safety interlocks, electrical interlocks, fire protection, etc.) If reference is made to SCSSCs, terminology should be consistent with that used for SCSSCs.
  * Environmental limits (e.g. potential air emissions, contamination of the groundwater)

III. Accelerator Readiness for Commissioning and Operation

Defines the required readiness elements, including those identified in the SAD that are required to be in place during the commissioning and operation stages to ensure safe operation. Requirements from other documents should be included, as appropriate, for completeness. The elements that should be described are:

IV. Qualification of Personnel

- Readiness of safety systems
- Shielding readiness and/or administrative procedures required
- Plan for commissioning/operation
- Environmental monitoring considerations.

IV. Decontamination and Decommissioning (D&D)

FESHM 8070 provides Fermilab requirements on this topic. This chapter shall discuss particular D&D provisions made for the accelerator or module covered by a given SAD.

V. Conclusion

At this point it should be possible to briefly conclude that the construction, operation and the final D&D may be conducted in manner acceptable by safety and environmental standards.

SAFETY ASSESSMENT DOCUMENT
ACCELERATOR READINESS REVIEW
DOCUMENTATION FORM

This form records the PSAD/SAD/ARR review process required for operations at Fermi National Accelerator Laboratory.

PSAD/SAD/ARR TITLE AND DATE: _____

_____

_____

THIS DOCUMENT DESCRIBES:

New Facility	_____	New Experiment	_____
Existing Facility	_____	Major Modification	_____
Entire Program	_____	Decommissioning	_____
Readiness Review	_____		

FERMI NATIONAL ACCELERATOR LABORATORY

Safety Assessment Document Approval _____ Completion of Readiness Review _____
Authorization to Operate Facility _____ Program/Facility Requires PSAD_____

Project Leader/Date: _____
Fermilab Division/Section/Center Head(s)/Date: _____

_____

Fermilab ES&H Director/Date: _____

Fermilab Director/Date: _____
(if appropriate)